UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Communications and Information
Washington, D.C. 20230

MAR 30 1999

WT Docket No. 00-32

The Honorable William E. Kennard
Chairman
Federal Communications Commission
The Portals
445 Twelfth Street, S.W.
Washington, D.C. 20554

Dear Chairman Kennard:

On behalf of the President, I am transmitting the Statement of Reasons for reclaiming the 4635-4685 Megahertz (MHz) band, which had been reallocated to the private sector in response to the Omnibus Budget Reconciliation Act of 1993 (OBRA-93), and identifying as substitute alternative spectrum, the 4940-4990 MHz band.

In 1995, the National Telecommunications and Information Administration, in coordination with the Federal agencies, identified the 4635-4685 MHz band for reallocation from Federal use to private use on an exclusive basis. Based on information derived subsequent to OBRA-93 reallocation decisions, the Department of Defense has concluded that the loss of this spectrum would seriously jeopardize the national security interests of the United States. As set forth in the enclosed Statement of Reasons, the loss of this spectrum would impact the operational capabilities of the Navy's Cooperative Engagement Capability (CEC) Program, which is a vital component to national defense.

The reclamation of the 4635-4685 MHz band and the substitution of the 4940-4990 MHz band will avert the operational impact to the Navy and preserve the monies already expended in the $3 billion CEC Program. Further, this substitution will neither disrupt nor displace any private sector entities. Although the Federal Communications Commission has reallocated the 4660-4685 MHz portion of the 4635-4685 MHz band to the General Wireless Communications Service (GWCS), it has not yet conducted an auction of this spectrum or issued any commercial licenses in this portion of the band. Thus, there is no cost to the private sector associated with the frequency band substitution.

If you have any further questions, please do not hesitate to let me know.

Sincerely,

Larry Irving

Larry Irving

Enclosure

STATEMENT OF REASONS

Introduction

In 1993, Congress passed the Omnibus Budget Reconciliation Act of 1993 (OBRA-93), which required under Title VI, the identification of at least 200 MHz of Federal spectrum for reallocation to private sector uses. The intent of the Act was to benefit the public by promoting the development of new emerging telecommunications technologies, products and services. The procedures of OBRA-93 included a number of band-identification criteria intended to achieve a reasonable balance between providing new spectrum resources for the public while providing adequate safeguards for incumbent Federal services. These safeguards included, among others, authority for the President to substitute alternative spectrum for spectrum reallocated under the Act.

In 1995, the National Telecommunications and Information Administration (NTIA) issued a report, pursuant to the requirements of OBRA-93, that identified a total of 235 MHz of Federal spectrum for reallocation.[1] The final reallocation plan took into account comments from the public and was prepared in coordination with all Federal agencies that are major users of Federal spectrum. The reallocation plan included a 50 MHz band segment from 4635 to 4685 MHz, a band which is used predominantly by the Department of Defense. The Navy's Cooperative Engagement Capability (CEC) system [2] is being developed to operate in this band.

Presidential Authority to Substitute Spectrum

The provisions of OBRA-93 authorize the President to substitute alternative frequencies for those identified in the original reallocation plan under certain circumstances and following certain procedures. *See* 47 U.S.C. §§ 924(b), 926. To substitute alternative frequencies, the President must determine that one or more of the following circumstances exists:

> (A) the reassignment would seriously jeopardize the national defense interests of the United States;
> (B) the frequency proposed for reassignment is uniquely suited to meeting important governmental needs;
> (C) the reassignment would seriously jeopardize public health or safety;
> (D) the reassignment will result in costs to the Federal Government that are excessive in relation to the benefits that may be obtained from commercial or other non-federal uses of the reassigned frequency; or
> (E) the reassignment will disrupt the existing use of a Federal Government band of frequencies by amateur licensees.

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1 National Telecommunications and Information Administration, U.S. Department of Commerce, NTIA Special Publication 95-32, *Spectrum Reallocation Final Report* (Feb. 1995).

2 The CEC system provides for self-defense among ships engaged in areas close to land through distribution of common radar and other data to all Cooperating Units in the battle group.

The President must submit a statement of reasons for taking such action to the Federal Communications Commission, the Committee on Commerce of the House of Representatives, and the Committee on Commerce, Science and Transportation of the Senate, 47 U.S.C. § 924(b)(1)(B). If the frequencies to be reclaimed for Federal Government use have been allocated or assigned by the Commission, the statement of reasons must also include a timetable for transition for private sector licensees and estimated costs of displacing such licensees, 47 U.S.C. § 926(b)(2).

Determination of Jeopardy to the National Defense Interests of the United States

Based on information derived subsequent to the OBRA-93 reallocation decisions,[3] the Department of Defense has now concluded that the loss of the 4635-4685 MHz band within the spectrum used for the CEC Program would seriously jeopardize the national security interests of the United States (see Annex A). The loss would impact the operational capabilities of the CEC Program in two respects: (1) it represents a potentially significant decrease in radio frequency (RF) bandwidth available to CEC; and (2) it raises significant adjacent band interference concerns with non-government users.

Impact on the CEC Program from a Reduction in RF Bandwidth

The loss of the 4635-4685 MHz band results in a potentially significant decrease in the overall RF bandwidth available to the CEC Program. The operational impact of the decrease in the RF bandwidth available to CEC includes a decrease in the number of Cooperating Units (CU)[4] that can simultaneously participate in a CEC network. This decrease degrades the overall warfighting capabilities of the network, the individual CUs that comprise the network, and the individual combatants that must be purposely omitted from the network. The Chart in Annex B illustrates the complex environment of the littoral battlefield in which the CEC system is expected to operate. A realistic war-battlefield scenario includes friendly, hostile, and neutral forces; advanced cruise missile, electronic-warfare, and tactical ballistic missile threats; and a multitude of allied combatants with multiple sensors and weapons that must be closely coordinated.

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[3] As described in a report by the Government Accounting Office, the Navy began research on the CEC system in the 1980's, which was significantly expanded and converted to an acquisition program in 1993. *See Defense Communications, Federal Frequency Spectrum Sale Could Impair Military Operations*, GAO/NSIAD-97-131 (June 1997). In 1993, Congress also directed the Army and Air Force to study CEC's potential to support joint air defense operations and theater ballistic missile defense missions. In his testimony on the fiscal year 1997 budget, the Secretary of Defense identified CEC as a high-priority program and directed its accelerated development because of its great potential for increasing the war-fighting capability of joint service operations. *Id.* at 6.

[4] Cooperating Units include, but not limited to, ships, aircraft, and land units in a battle group in which the CEC system distributes the same radar and other data to provide each unit with the same near real-time composite picture of the battle environment.

The exchange of sensor and weapon data is the critical function that allows individual combat units participating in a CEC network to have identical tactical pictures resulting in: (1) increased warfighting capability by forming a composite sensor track and identification data base that facilitates the use of advanced tactics and doctrine and (2) increased warfighting effectiveness by functioning as a single, coordinated battle force. The total RF bandwidth required for a network depends on the number of combatants participating in that network, and likewise, the number of CEC units which can participate in a network is limited by the RF bandwidth available.

Maximum war fighting effectiveness and capability are achieved when the greatest number of units participate in CEC. Since CEC is designated for deployment aboard all U.S. Navy major combatants and E-2C aircraft, a significant number of units will be required to participate in CEC networks. Additional CEC units are expected to be added to the networks with addition of joint service units in the near future. To achieve these large CEC networks requires a significant total RF bandwidth.

The result of a spectrum allocation to CEC that supports participation of less than the maximum number of units will be that a battle force commander must decide which elements of the battle force to omit from CEC. For each unit omitted, CEC effectiveness is reduced, and consequently, the warfighting effectiveness of the battle force is reduced. Likewise, the warfighting capability of each combat element omitted from CEC is underutilized.

A second major impact of a reduction in the spectrum allocated to CEC is the effect on training and, consequently, combat readiness. The comprehensive training required to provide operational readiness in all of the capabilities of CEC is essential for effective deployment under both peacetime and wartime conditions. This training includes the development of operational tactics and doctrine to ensure that a battle force operates as a single, cohesive combat unit, and realizes full CEC potential.

Because of the Department of Defense doctrine to train as they fight, the participation of the maximum number of CEC units is essential to realize full warfighting effectiveness. Comprehensive training with the maximum number of units is essential for a unified battle force to become thoroughly familiar with all CEC capabilities and, as a result, achieve full combat readiness. Additionally, this training must be accomplished in geographic areas that simultaneously: (1) provide environments that simulate the littoral conditions under which future conflicts are expected to occur; and (2) minimize the exposure of training forces to both security and safety risks. The coasts of and areas within the United States and Possessions provide such geographic areas.

To accomplish this training in the appropriate environment requires that adequate frequency spectrum be available to CEC both along the coasts as well as inland. A decrease in frequency spectrum available to CEC forces results in training with reduced numbers of units participating in exercises along the coasts of or within the United States. The only other options are more difficult and expensive in terms of time and cost and include training: (1) in an open ocean environment, (2) at a remote littoral location outside of the United States to accommodate large numbers of units, or

(3) with increased reliance on computer modeling and simulation.

Training with reduced numbers of units reduces operational readiness. An open ocean environment precludes training with ground forces of the U.S. Army or U.S. Marine Corps, and does not provide a realistic littoral environment that are representative of locations in which future conflicts are expected to occur. Training in littoral environments outside of the United States risks compromise of both security and safety, and adds to the cost and length of deployment from home ports. The risks associated with training simulations are not fully identified.

Adjacent Band Interference Considerations

Because the 4635-4685 MHz band is in the center portion of the spectrum used for the CEC Program, its loss also raises significant concerns regarding adjacent band interference with non-government users of the reallocated segment. Because of the relatively high transmitter power of the CEC and the undefined nature of the non-government receivers, adjacent band interference conflicts are likely to occur, requiring technical or operational constraints to assure satisfactory performance. These adjacent band interference constraints may be required on both sides of the reallocated segment when that segment is located near the center of the CEC RF band.

The electromagnetic compatibility between the CEC and potential systems that will be operating in the adjacent bands is a function of the type of architecture selected for the commercial receiver design, the bandwidth of the commercial receiver, and the technology and design selected for filters incorporated within the commercial receiver, among other factors. Adjacent band interference can be reduced with proper architecture and filter selection for the commercial receiver. However, this process could increase the cost of the commercial systems. Since Federal Communications Commission regulations do not mandate that commercial receivers achieve some standard of interference rejection, a commercial system will normally be designed to optimize factors such as performance, cost or size.

These adjacent band interference concerns can be partially mitigated by relocating the reallocated segment from near the center of the CEC RF band to the upper edge of the CEC RF band as this Presidential substitution does. In this case, potential adjacent band interference between the CEC and non-government systems can only occur on one side of the reallocated segment. This would result in fewer instances of adjacent band interference and reduced frequency coordination requirements. To further reduce adjacent band interference, pertinent CEC technical parameters are provided to potential users in the band (see Annex C).

Substituted Spectrum

The 4940-4990 MHz band at the upper edge of the CEC spectrum is being substituted for the 4635-4685 MHz band at the center of the CEC spectrum for exclusive non-Federal use. Upon completion of rulemaking by the Federal Communications Commission reallocating the substituted band, current Federal assignments supporting fixed and mobile services (see Annex D), except radio

astronomy operations,[5] will be withdrawn or limited in accordance with the procedures defined by OBRA-93. Withdrawn Federal assignments could be potentially re-tuned in the lower portion of the 4 GHz fixed and mobile services band (i.e., 4400-4940 MHz). [6]

This substitution will significantly reduce adjacent band interference conflicts between the CEC program and adjacent non-government spectrum users since only one side of the reallocated segment will be involved. Additionally, the relocation of the commercial segment to the upper edge of the band reduces the CEC radiated out of band emission levels across the segment. Designers of commercial systems will then be able to implement less stringent designs and, consequently, reduce the cost to operate in the presence of those emissions.[7]

Potential Effect on Private Sector Licensees

The Federal Communications Commission has not issued licenses in the 4635-4685 MHz band, and therefore, this substitution will not displace or impose costs upon private sector licensees.[8] The 4635-4685 MHz band was identified for reallocation in the NTIA plan in two equal band segments, 4635-4660 and 4660-4685 MHz. The latter band was identified for immediate reallocation in 1994 and the former band was identified for reallocation in 1997 to allow adequate time for re-design of certain military telemetry systems.[9]

In 1995, the Federal Communications Commission completed a rulemaking on the 4660-4685 MHz portion of the band, which was reallocated to the General Wireless Communications Service

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[5] To protect radio astronomy operations in the 4940-4990 MHz band, as well as, the 4990-5000 MHz adjacent band, non-Federal services shall not include air-to-ground or space-to-Earth links. In addition, allocation footnote US257 will be retained regarding continued radio astronomy use of the 4950-4990 MHz band.

[6] The Departments of Justice, Treasury and Energy have 35, 5, and 4 frequency assignments in the 4940-4990 MHz band, respectively. NTIA anticipates that these agencies will explore re-tuning as the most cost-effective option.

[7] The relocation of the frequency segment to the upper edge of the CEC RF band provides a benefit to developers of commercial systems that will operate in the segment. The out of band emission levels across the upper half of the relocated segment are reduced when compared with the emission levels across the upper half of the current segment. For reference, see the CEC emission characteristic curve shown in Annex C. Designers of commercial systems that will operate in the band can then implement designs with architectures, filter types, and filter technologies that reduce the overall costs of these systems.

[8] Moreover, successful bidders will not be required to compensate Federal agencies required to relocate as a result of this action. See Defense Authorization Act of 1998, Pub. L. No. 105-261 (1998)(amending 47 U.S.C. § 923(g)).

[9] *See supra* note 1 at 5-5.

(GWCS).[10] The Commission announced that GWCS licenses were to be issued by auction in 1998, but the auction was subsequently postponed indefinitely.[11] No GWCS licenses have been issued to date. No formal Commission action has been initiated to reallocate the 4635-4660 MHz portion of the band.[12]

Conclusion

Reallocation of the 4635-4685 MHz band would jeopardize the national security interests of the United States, and therefore, pursuant to the authority set forth in 47 U.S.C. §§ 924(b), 926, this band is reclaimed for Federal Government uses and the 4940-4990 MHz band is substituted for reallocation to private sector uses by the Federal Communications Commission. This substitution will offer increased benefits to the public while also significantly reducing adverse impact to the Navy CEC system. Because there will no adverse affects on private sector spectrum users, this substitution can take effect immediately.

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10 Allocation of Spectrum Below 5 GHz Transferred from Federal Government Use, *Second Report and Order*, ET Dkt. No. 94-32, FCC 95-319 (Aug. 2, 1995). The frequency blocks are codified at 47 C.F.R. § 26.103.

11 *See* "FCC Announces Auction Schedule for the General Wireless Communications Service," Public Notice DA 97-2634 (Dec. 17, 1997); "Wireless Telecommunications Bureau Announces Postponement of General Wireless Communications (GWCS) Auction," Public Notice DA 98-792 (April 24, 1998); *see also* General Wireless Communications Service (GWCS) Auction Fact Sheet at http://www.fcc.gov/wtb/auctions/gwcs/gwcs1fct.html.

12 The Commission has indicated that it is working on a Notice of Proposed Rulemaking on this portion of the band. *See* Allocation of Spectrum Below 5 GHz Transferred from Federal Government Use, *Fourth Report and Order*, ET Dkt. No. 94-32, ¶ 2 (Sept. 24, 1998).

ANNEX - A

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
6000 DEFENSE PENTAGON
WASHINGTON, DC 20301-6000

COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE

January 28, 1999

Honorable Larry Irving, Jr.
Assistant Secretary for Communications
and Information and
Administrator of National Telecommunications
and Information Administration
U.S. Department of Commerce
14th Street and Constitution Avenue, N. W.
Washington, D. C. 20230

Dear Mr. Irving:

Request that our Department and NTIA jointly pursue a course of action to invoke Presidential authority to reclaim the 4635-4685 MHz band and substitute the 4940-4990 MHz band. This will avert unrecoverable operational impact to the Navy's Cooperative Engagement Capability (CEC).

Title VI of the Omnibus Budget Reconciliation Act of 1993 (OBRA-93) directed the reallocation of at least 200 MHz of U. S. Government primary-use frequency spectrum for commercial use. Of the 235 MHz ultimately identified under this act, 50 MHz is located in the 4635-4685 MHz band used by the Department of Defense for CEC. Based on information derived subsequent to that reallocation decision, this loss of frequency spectrum use has created a situation that may seriously jeopardize the national defense interests of the United States.

The Department has reviewed the impact of the reallocation on our military operations. The goal of this review has been to explore technical and cost-effective alternatives that would not only reduce the impact on military operations, but would also improve the effective use of the spectrum for the benefit of both the military and the commercial sector.

The review reflects a significant impact on the Department's tactical requirements in the 4635-4685 MHz band. The impact is further exacerbated by the need for creation of significant guard bands on either side of the affected band, to preclude interference with commercial users as shown in Enclosure 1. Alternatively, if this portion of the reallocation could be moved

to the 4940-4990 MHz band, the need for one of these guard bands could be eliminated. The spectral roll-off of CEC adjacent to the proposed relocated commercial band is shown in Enclosure 2.

Our request to use Presidential authority is consistent with Section 116 of OBRA-93 "Authority to Recover Reassigned Frequencies." OBRA-93 provides that alternative bands that might be of more value to the private sector, and cause less impact to the military, can be identified for reallocation.

We are confident that a favorable outcome of this proposed change will have beneficial effects for the commercial interests as well as the military. Therefore, in the interest of seeking a mutually satisfactory resolution to this problem, your support is solicited.

My point of contact in the Spectrum Management Directorate for this effort is Lt Col Rick Reaser, (703) 607-0726.

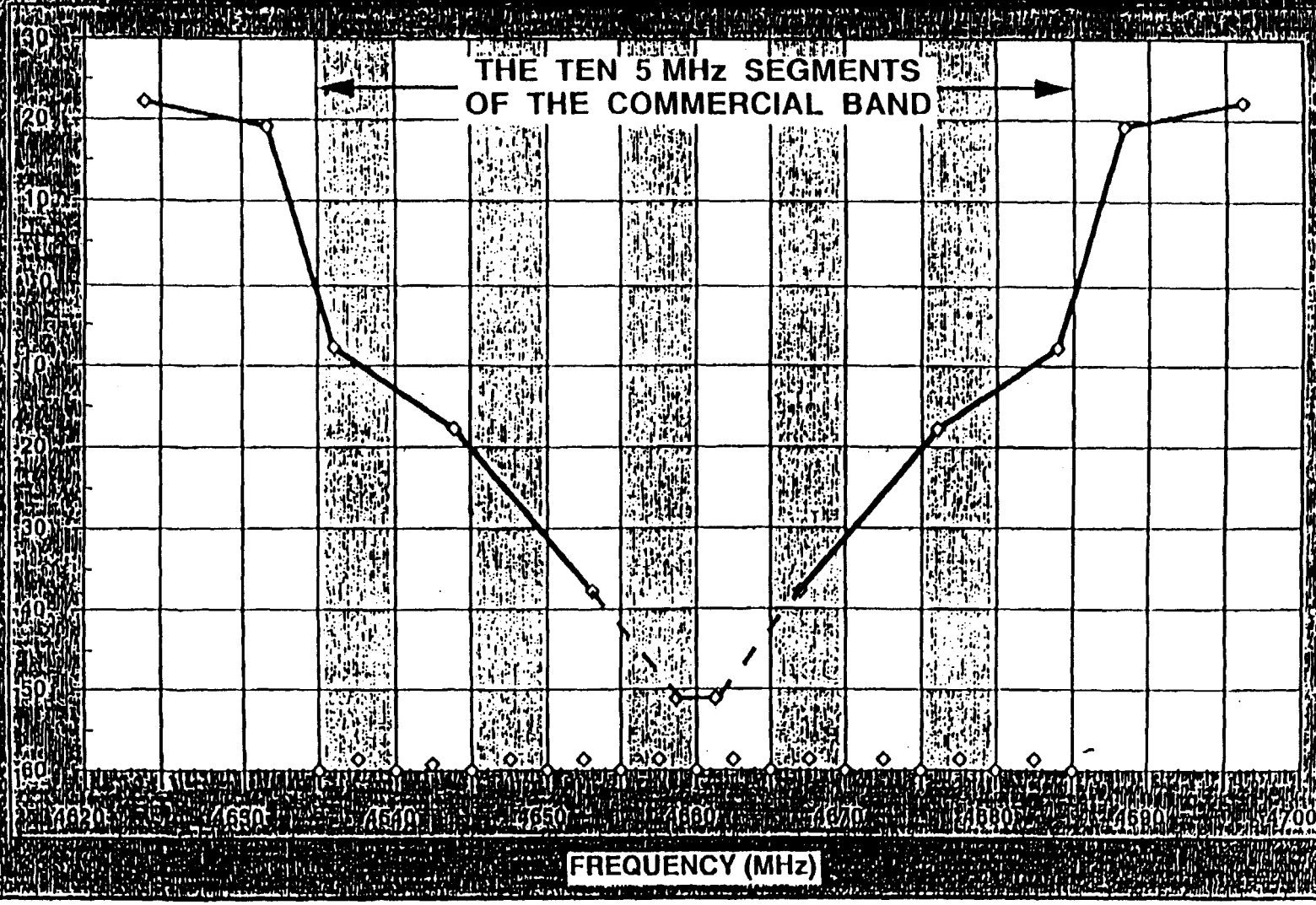
Sincerely,

Arthur L. Money
Senior Civilian Official

Enclosures:
1. CEC Spectral Roll-Off Adjacent to the Commercial Band
2. CEC Spectral Roll-Off Adjacent to the Relocated Commercial Band

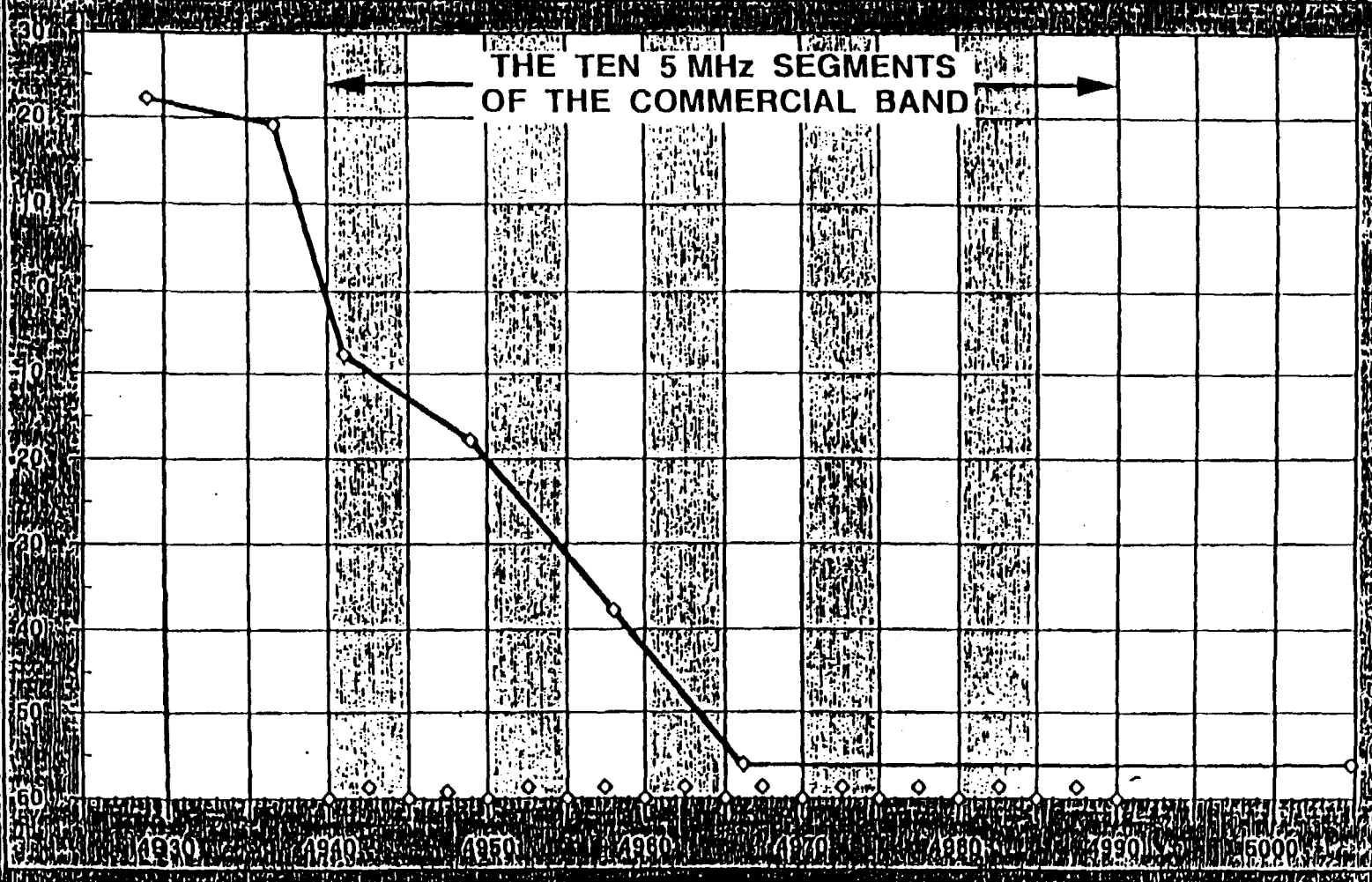
CEC SPECTRAL ROLL OFF ADJACENT TO THE COMMERCIAL BAND

CEC PROVIDES 11 MHz GUARDBAND IAW NTIA REGULATIONS



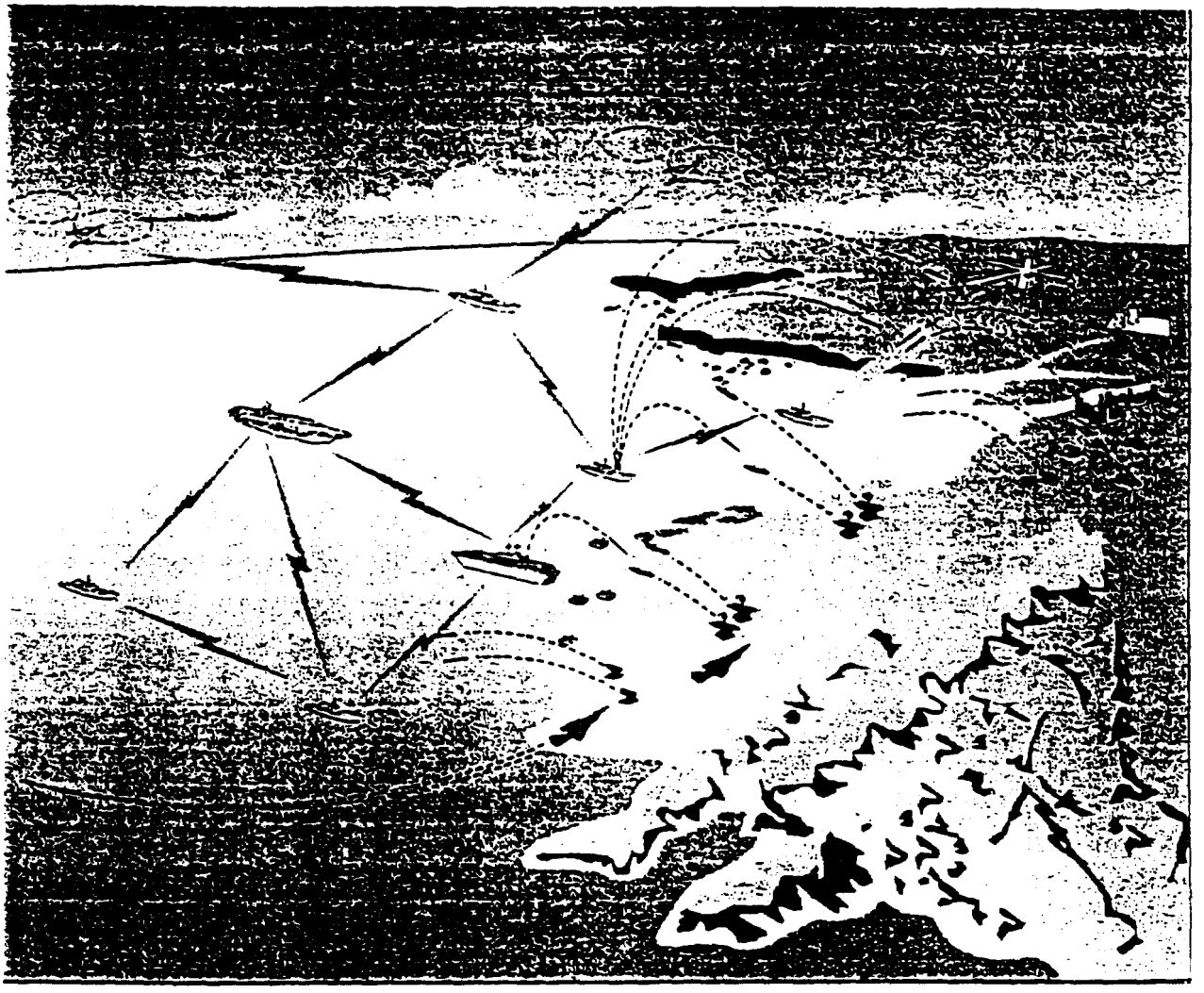
CEC SPECTRAL ROLL OFF ADJACENT TO THE RELOCATED COMMERCIAL BAND

CEC PROVIDES 11 MHz GUARDBAND IAW NTIA REGULATIONS



ANNEX B

COOPERATIVE ENGAGEMENT CAPABILITY SYSTEM LITTORAL BATTLEFIELD COMPLEX ENVIRONMENT



Note: This chart only illustrates some of the cooperating units that may comprise a CEC battle force. Realistically, there are other components to the CEC battle force. However, the chart shows an example complex environment of the littoral battlefield in the which the CEC system is expected to operate.

ANNEX C

TECHNICAL DATA on the NAVY COOPERATIVE ENGAGEMENT CAPABILITY (CEC) SYSTEM

Introduction

The purpose of this annex is to describe the technical characteristics of the Navy Cooperative Engagement Capability (CEC) Data Distribution System. The CEC, a major communications system being developed by the military to provide connectivity between air, land, and sea units for Theater Air Defense, will operate in the bands immediately adjacent to the 4940-4990 MHz band. In order to minimize mutual interference between the CEC system and prospective users, certain CEC technical characteristics are being made publicly available so that commercial equipment can be designed to reduce susceptibility to interference. While details of the overall CEC program will remain unavailable for public release, the technical parameters as described below have been recently declassified to facilitate the release of this basic data.

Operating Areas

The location in which large numbers of CEC nodes will be operating includes a number of naval/joint military exercise areas. Because CEC units may be on ships and aircraft, and/or at land based sites, the normal operating areas are coastal waters and the contiguous land mass extending 30 nautical mile inland. A more detailed description of expected operating areas is included in Enclosure (1).

Technical Parameters

The CEC operates on multiple frequencies in the bands below the 4940-4990 MHz band. The authorized bandwidth of the transmitted signal on a specific frequency is 22 MHz. In order to comply with NTIA regulations, the authorized bandwidth will be contained wholly within the adjacent Federal band so that it does not impinge upon the 4940-4990 MHz band. In other words, the center frequency of any CEC transmitted signal will not fall above the frequency 4929 MHz.

The CEC system employs high power transmitters with directional antennas to achieve a maximum e.i.r.p. of 58 dBW (630 kW). The CEC emission characteristic was designed to be highly spectrally efficient to significantly exceed NTIA requirements for unwanted emissions. Specific spectral parameters are as follows:[1]

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[1] The unit of dBc refers to dB below the carrier power. The unit of dBc/Hz refers to dB below the carrier power measured in a one Hz bandwidth.

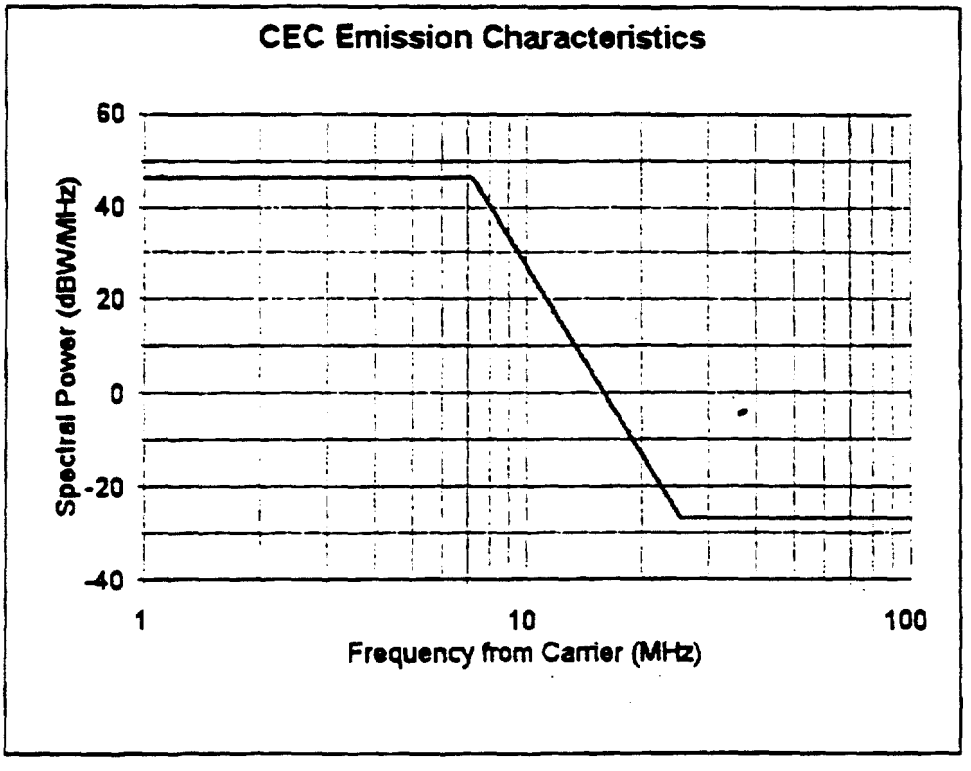
Out-of-Band Emissions

1. At +/- 7.65 MHz from the tranmitter center frequency	-3 dBc
2. At +/- 12.1 MHz from the transmitter center frequency	-30 dBc

Transmitter Noise at greater than +/- 25.6 MHz from the transmitter center frequency — Less than -145 dBc/Hz

Harmonics and Spurious — Less than -80 dBc

These emission characteristics have been scaled to convenient units of dBW/MHz and plotted in the Figure below.



Enclosure 1

COOPERATIVE ENGAGEMENT CAPABILITY OPERATING AREA DESCRIPTIONS

Eight areas are identified as essential to support training with a large number of Cooperating Units (CUs) in a CEC network. The potential locations of CEC terminals within these areas are described below. The significance of these areas is that Navy expects to fly airborne CEC units with high power transmitters directly above these areas and extending out to sea in and around existing military operational areas. The coordinates are shown in brackets:

1. The area extending 30 nautical miles (nm) inland from the Atlantic Ocean between Wilmington, North Carolina (NC) [34°08'14"N, 77°53'26"W] and Lewes, Delaware (DE) [38°46'29"N, 75°07'37"W] facilitate Atlantic Fleet exercises. The land based CEC terminals at Wallops Island, Virginia (VA), Eastville, VA, and Dam Neck, VA are within the boundaries established for the Atlantic Fleet exercises. The Cherry Point and Onslow Bay NC areas are also included. The Naval Air Warfare Center (NAWC) at Patuxent River, Maryland (MD) and facilities at Greenville, South Carolina (SC), Jacksonville, Florida (FL), and St. Petersburg, FL are not included in the inland areas. The exclusion of the four sites does not preclude CEC Radio Frequency (RF) emissions at these sites.

2. The area extending 30 nm inland from the Gulf of Mexico between the Louisiana (LA)-Mississippi (MS) state border [30°11'06"N, 89°30'53"W] and Panama City, FL [30°09'26"N, 85°39'41"W] , to support Gulf of Mexico exercises. The area includes Gulfport and Biloxi, MS, and Pensacola and Eglin AFB, FL.

3. The area extending 30 nm inland from the Pacific Ocean between Vandenberg Air Force Base (AFB), California (CA) [34°06'05"N, 119°06'52"W] and Point Mugu Naval Air Station (NAS), CA [34°43'42"N, 120°34'31"W] , to support Pacific Fleet exercises.

4. The area extending 30 nm inland from the Pacific Ocean between Newport Beach, CA, [33°38'02"N, 117°52'25"W] and the CA-Mexico international border [32°32'00"N, 117°07'30"W] to support Pacific Fleet exercises. The area includes Camp Pendleton, CA.

5. The area that includes the White Sands Missile Range, New Mexico (NM) [32°22'29"N, 106°27'56"W] and the Fort Bliss Military Reservation, Texas (TX) and NM [31°48'25"N, 106°24'56"W], to support the joint Chiefs of Staff Roving Sands Exercise.

6. The area that includes the China Lake Naval Weapons Center [35°39'01"N, 117°39'58"W] and the Fort Irwin Military Reservation, CA [35°15'00"N, 116°40'00"W].

7. All of Hawaii, including the Pacific Missile Range Facility (PMRF).

8. All of Puerto Rico, including the Armed Forces Weapons Test Facility (AFWTF).

ANNEX D

FEDERAL USE of the 4940-4990 MHz BAND

Introduction

This section provides an overview of the current use of the 4940-4990 MHz band. Additional information may be found in the *Spectrum Reallocation Final Report*.[1] As mentioned previously, Federal assignments supporting fixed and mobile services, except radio astronomy operations, will be withdrawn or limited in accordance with the procedures defined by OBRA-93.

Current Federal Spectrum Usage in the 4940-4990 MHz Band

The 4940-4990 MHz band segment is a part of the 4 GHz fixed and mobile services band (i.e., 4400-4990 MHz band). The entire 4 GHz band is designated in the United States and throughout the NATO Alliance countries to meet military requirements for fixed and mobile communications. Typical fixed uses include conventional point-to-point microwave, tactical radio relay and high power tropospheric scatter systems.

Mobile applications include control of remote piloted vehicles, video and data telemetry links, target drone control links, and fleet defense systems. The aerostat systems, tethered at an altitude of approximately 15000 feet above mean sea level, are an important part of U.S. drug interdiction efforts along the U.S. southern borders.

Since the band being reclaimed (i.e., 4635-4685 MHz) and the band being proposed for substitution are parts of the 4 GHz fixed and mobile services band, Federal use on these band segments are fundamentally the same.

The Federal users of the 4940-4990 MHz band are listed in Table 1. A total of 188 Federal frequency assignments are currently authorized. Note that, as a whole, the DoD is the major user of the band with 76% of the total assignments or 143 assignments. The specific uses for each Federal agency is described below.

About 50% of the Air Force assignments are experimental that support electronic warfare activities, specifically, to train aircrews in electronic combat. The rest are for backbone microwave links to transfer radar data, missile testing, tactical training, line-of-sight radio relay and tropospheric (tropo) communication links. The Army and Navy also use this band for similar operations. In addition, both agencies have requirements for either ground-to-ground or air-to-ground video data link transfer. These video links require wide emission bandwidths of about 20-30 MHz. One of the

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[1] *Spectrum Reallocation Final Report, Supra* note 1.

TABLE 1: FEDERAL USERS OF THE 4940-4990 MHz BAND

Agency	No. of Frequency Assignments	General Main Uses
Air Force	106 & 3 Radio Solar Telescope Network Site [a]	Tactical Training Electronic Warfare Support
Army	9	Tactical Training Missile Support
Commerce	1	Experimental
Energy	11	Command & Control
Justice	35	Law Enforcement
Navy	28	Tactical Training, LAMPS,[c] Remotely Piloted Vehicle
NSF [b]	6 Installations [a]	Astronomy
Treasury	5	Law Enforcement

[a] These radio astronomy installations will need continued protection from interference in accordance with U.S. Footnote 257.
[b] National Science Foundation. Some of NSF's installations or operations are co-sponsored with other Federal Government or civilian entities (e.g., U.S. Naval Research Laboratory, NASA, California Institute of Technology, etc..).
[c] Light Airborne Multipurpose System

Navy's most significant and costly mobile applications that support fleet defense operations is the Light Airborne Multipurpose System (LAMPS). The operational LAMPS MK III system provides a full duplex wide band link between helicopters and ships. Another important Navy application in this band is for the command and control of remote piloted vehicles.

The major non-DoD Federal agency user of the 4940-4990 MHz band is the Department of Justice (DOJ) with 35 frequency assignments. DOJ together with the Department of Treasury (DOT) utilized this band for law enforcement activities. However, their use differ strategically. DOT basically uses this band at fixed locations along the southern U.S. border for drug interdiction. DOJ, on the other hand, employs its systems nationwide, including Hawaii and Alaska, wherever they are needed for gathering and transferring video data.

The Department of Energy's use of the band is localized at two major sites. The first is at the Nevada Test Site, where one way links for command, control and data transfer from test acquisition units to central control positions are facilitated. The other site is at Livermore, California. Operations at this site include data and voice communications in support of Energy's multi-site

trunking system.

The National Science Foundation conducts studies of the brightness distributions of both galactic and extra-galactic objects such as ionized hydrogen clouds and supernova remnants in certain radio frequency bands, including the 4940-4990 MHz band. Although, in the United States, this band is not allocated to radio astronomy service, radio astronomy operations are recognized as provided by U.S. Footnote 257. This footnote provides that radio astronomy observations may be made in the band at certain radio astronomy observatories and urges potential users of the band to take every practicable effort to avoid the assignment of frequencies to stations in the fixed and mobile services at certain geographic areas, as listed in Table 2. In addition, the footnote also encourages potential users to avoid the assignment of frequencies to stations in the aeronautical mobile service which operate outside of those geographic areas, but which may cause harmful interference to these observatories.

Considering that radio astronomy is a passive service, which deals only with the reception of cosmic radio waves, and the distance of possible cosmic radio source from the Earth, in which the potential received signal is exceptionally weak, it is extremely vulnerable to potential interference from other active services. To preclude the potential for interference to the radio astronomy service, the conditions set forth in footnote US257 should be adhered to by potential users of the band.

TABLE 2: RADIO ASTRONOMY OBSERVATIONS AS PER U.S. FOOTNOTE 257

Observatories	Location	Latitude/Longitude	Potential Operating Freq. Band (GHz)	Observation Type
National Astronomy & Ionosphere Center	Arecibo, Puerto Rico	Rectangle between latitudes 17°30'N and 19°00'N and between latitudes 65°10'W and 68°00'W	3.95-6.05	Spectral Line
Haystack Radio Observatory	Tyngsboro, Massachusetts	Rectangle between latitudes 41°00'N and 43°00'N and between latitudes 71°00'W and 73°00'W	Not Available	Spectral Line, Continuum, & VLBI
National Radio Astronomy Observatory	Green Bank, West Virginia	Rectangle between latitudes 37°00'N and 39°15'N and between latitudes 78°30'W and 80°30'W	4.47-5.05 4.6-5.0 4.6-5.1 4.7-7.2	Continuum, Spectral Line, & VLBI
National Radio Astronomy Observatory	Socorro, New Mexico	Rectangle between latitudes 32°30'N and 35°30'N and between latitudes 106°00'W and 109°00'W	4.6-5.1	Continuum, Spectral Line, & VLBI
Owens Valley Radio Astronomy	Big Pine, California	Two Contiguous rectangles, one between latitudes 36°00'N and 37°00'N and between longitudes 117°40'W and 118°30'W and the second between latitudes 37°00'N and 38°00'N and between longitudes 118°00'W and 118°50'W	4.75-5.15 0.5-18.0 2.4-8.2	Solar
Hat Creek Observatory	Hat Creek, California	Rectangle between latitudes 40°00'N and 42°00'N and between longitudes 120°15'W and 122°05'W	4.5-5.0	VLBI, Spectral Line

* Very-Long-Baseline Interferometry.